



Full wwPDB X-ray Structure Validation Report ⓘ

May 14, 2020 – 04:12 am BST

PDB ID : 5WUM
Title : Crystal structure of mouse importin-alpha1 bound to S385-phosphorylated NLS of EBNA1
Authors : Nakada, R.; Hirano, H.; Matsuura, Y.
Deposited on : 2016-12-19
Resolution : 2.00 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.11
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.11

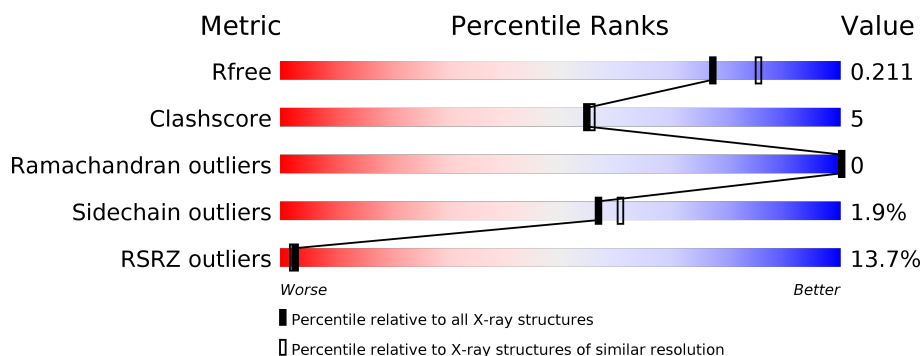
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.00 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	8085 (2.00-2.00)
Clashscore	141614	9178 (2.00-2.00)
Ramachandran outliers	138981	9054 (2.00-2.00)
Sidechain outliers	138945	9053 (2.00-2.00)
RSRZ outliers	127900	7900 (2.00-2.00)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments on the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	460	<div> <div>13%</div> <div>82%</div> <div>10%</div> <div>7%</div> </div>
2	B	9	<div> <div>22%</div> <div>78%</div> <div>11%</div> <div>11%</div> </div>
2	C	9	<div> <div>67%</div> <div>33%</div> </div>

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 3621 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Importin subunit alpha-1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	426	Total	C	N	O	S	0	0	0
			3244	2066	550	618	10			

- Molecule 2 is a protein called Epstein-Barr nuclear antigen 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	8	Total	C	N	O	P	0	0	0
			66	37	15	13	1			
2	C	6	Total	C	N	O		0	0	0
			53	31	13	9				

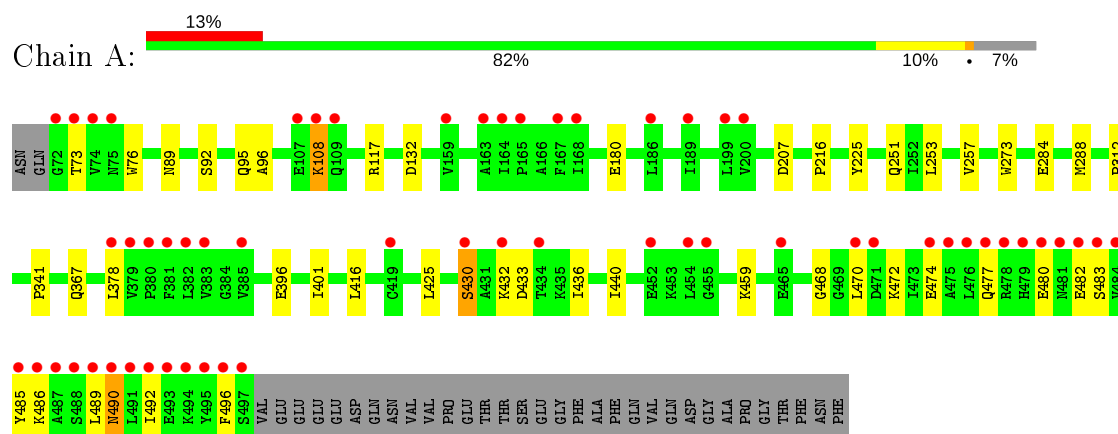
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	247	Total	O	0	0
			247	247		
3	B	4	Total	O	0	0
			4	4		
3	C	7	Total	O	0	0
			7	7		

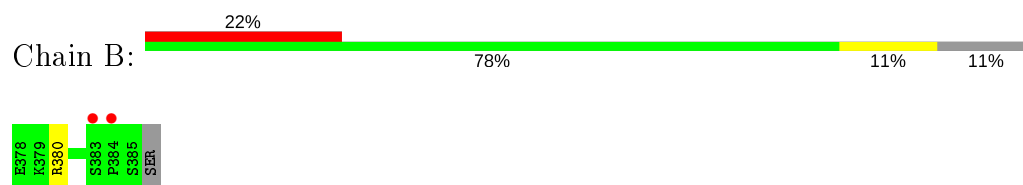
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

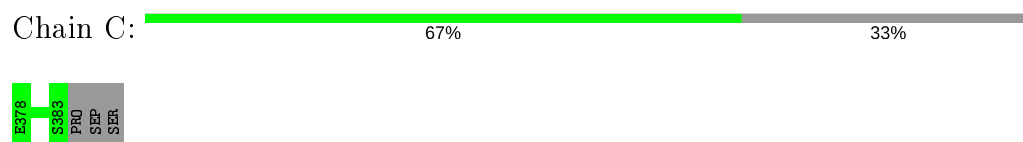
• Molecule 1: Importin subunit alpha-1



• Molecule 2: Epstein-Barr nuclear antigen 1



• Molecule 2: Epstein-Barr nuclear antigen 1



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	77.91Å 90.30Å 99.63Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	39.06 – 2.00 39.06 – 2.00	Depositor EDS
% Data completeness (in resolution range)	99.9 (39.06-2.00) 99.9 (39.06-2.00)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.64 (at 2.00Å)	Xtriage
Refinement program	PHENIX 1.11.1 _2575	Depositor
R, R_{free}	0.186 , 0.211 0.186 , 0.211	Depositor DCC
R_{free} test set	2434 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å ²)	33.3	Xtriage
Anisotropy	0.425	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 52.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	3621	wwPDB-VP
Average B, all atoms (Å ²)	43.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.83% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: SEP

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# $ Z > 5$	RMSZ	# $ Z > 5$
1	A	0.27	0/3302	0.43	0/4500
2	B	0.24	0/57	0.36	0/75
2	C	0.27	0/53	0.47	0/68
All	All	0.27	0/3412	0.43	0/4643

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3244	0	3320	35	0
2	B	66	0	63	1	0
2	C	53	0	56	0	0
3	A	247	0	0	2	0
3	B	4	0	0	0	0
3	C	7	0	0	0	0
All	All	3621	0	3439	35	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 5.

All (35) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:216:PRO:O	3:A:601:HOH:O	1.99	0.80
1:A:108:LYS:HD3	1:A:108:LYS:H	1.51	0.75
1:A:474:GLU:HG2	1:A:492:ILE:CD1	2.18	0.73
1:A:482:GLU:HG2	1:A:486:LYS:HE2	1.72	0.71
1:A:474:GLU:HG2	1:A:492:ILE:HD13	1.73	0.70
1:A:470:LEU:O	1:A:474:GLU:HG3	1.93	0.69
1:A:76:TRP:HH2	1:A:95:GLN:NE2	1.91	0.69
1:A:430:SER:HB2	1:A:472:LYS:NZ	2.17	0.59
1:A:95:GLN:HG3	1:A:96:ALA:N	2.17	0.58
1:A:207:ASP:OD1	1:A:251:GLN:NE2	2.37	0.57
1:A:474:GLU:HA	1:A:477:GLN:HG3	1.90	0.54
1:A:474:GLU:HG2	1:A:492:ILE:HD11	1.89	0.52
1:A:477:GLN:NE2	1:A:492:ILE:HD12	2.26	0.51
1:A:132:ASP:OD1	1:A:132:ASP:N	2.36	0.50
1:A:95:GLN:HG3	1:A:96:ALA:H	1.77	0.48
1:A:468:GLY:O	1:A:472:LYS:HG3	2.14	0.47
1:A:89:ASN:HB3	1:A:92:SER:HB2	1.96	0.47
1:A:470:LEU:HD13	1:A:496:PHE:CG	2.50	0.47
1:A:490:ASN:C	1:A:490:ASN:HD22	2.18	0.47
1:A:367:GLN:OE1	3:A:602:HOH:O	2.20	0.47
1:A:425:LEU:HD22	1:A:440:ILE:HG23	1.97	0.46
1:A:341:PRO:HD3	1:A:378:LEU:HD21	1.98	0.46
1:A:470:LEU:HD13	1:A:496:PHE:CD1	2.50	0.46
1:A:482:GLU:HG2	1:A:483:SER:N	2.32	0.45
1:A:396:GLU:OE1	2:B:380:ARG:NH2	2.41	0.44
1:A:253:LEU:O	1:A:257:VAL:HG23	2.19	0.43
1:A:273:TRP:CD2	1:A:312:PRO:HB3	2.54	0.43
1:A:477:GLN:HB3	1:A:489:LEU:HD11	2.01	0.43
1:A:433:ASP:HB3	1:A:436:ILE:HG22	2.02	0.42
1:A:73:THR:HA	1:A:76:TRP:NE1	2.35	0.41
1:A:482:GLU:CG	1:A:486:LYS:HE2	2.46	0.41
1:A:180:GLU:HB2	1:A:225:TYR:CD1	2.56	0.41
1:A:284:GLU:O	1:A:288:MET:HG3	2.21	0.40
1:A:117:ARG:HB3	1:A:117:ARG:NH1	2.36	0.40
1:A:401:ILE:HG23	1:A:416:LEU:HD21	2.04	0.40

There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 Protein backbone

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	424/460 (92%)	420 (99%)	4 (1%)	0	100	100
2	B	6/9 (67%)	6 (100%)	0	0	100	100
2	C	4/9 (44%)	4 (100%)	0	0	100	100
All	All	434/478 (91%)	430 (99%)	4 (1%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	357/386 (92%)	350 (98%)	7 (2%)	55	58
2	B	6/8 (75%)	6 (100%)	0	100	100
2	C	6/8 (75%)	6 (100%)	0	100	100
All	All	369/402 (92%)	362 (98%)	7 (2%)	57	61

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	108	LYS
1	A	430	SER
1	A	432	LYS
1	A	459	LYS
1	A	480	GLU

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Mol	Chain	Res	Type
1	A	485	TYR
1	A	490	ASN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	95	GLN
1	A	109	GLN
1	A	477	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

1 non-standard protein/DNA/RNA residue is modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	SEP	B	385	2	8,9,10	1.56	1 (12%)	8,12,14	0.95	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	SEP	B	385	2	-	4/5/8/10	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	385	SEP	P-O1P	3.38	1.61	1.50

There are no bond angle outliers.

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	385	SEP	N-CA-CB-OG
2	B	385	SEP	CB-OG-P-O2P
2	B	385	SEP	CB-OG-P-O3P
2	B	385	SEP	CB-OG-P-O1P

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

5.6 Ligand geometry [i](#)

There are no ligands in this entry.

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	426/460 (92%)	0.54	58 (13%) 3 2	23, 36, 83, 109	0
2	B	7/9 (77%)	1.45	2 (28%) 0 0	46, 54, 81, 82	0
2	C	6/9 (66%)	0.53	0 100 100	40, 46, 63, 65	0
All	All	439/478 (91%)	0.56	60 (13%) 3 2	23, 36, 83, 109	0

All (60) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	485	TYR	8.0
1	A	489	LEU	7.3
1	A	474	GLU	6.0
1	A	497	SER	6.0
1	A	478	ARG	5.7
1	A	496	PHE	5.6
1	A	476	LEU	5.5
1	A	484	VAL	5.5
2	B	384	PRO	5.4
1	A	492	ILE	5.3
1	A	74	VAL	5.2
1	A	479	HIS	4.6
1	A	455	GLY	4.4
1	A	475	ALA	4.4
1	A	432	LYS	4.2
1	A	107	GLU	4.2
1	A	72	GLY	4.1
1	A	480	GLU	4.1
2	B	383	SER	4.0
1	A	482	GLU	4.0
1	A	477	GLN	4.0
1	A	481	ASN	3.9
1	A	491	LEU	3.8

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Mol	Chain	Res	Type	RSRZ
1	A	75	ASN	3.7
1	A	493	GLU	3.7
1	A	383	VAL	3.4
1	A	108	LYS	3.2
1	A	495	TYR	3.1
1	A	109	GLN	3.0
1	A	494	LYS	2.9
1	A	199	LEU	2.9
1	A	454	LEU	2.8
1	A	381	PHE	2.8
1	A	486	LYS	2.7
1	A	452	GLU	2.7
1	A	186	LEU	2.7
1	A	189	ILE	2.7
1	A	159	VAL	2.6
1	A	419	CYS	2.6
1	A	483	SER	2.6
1	A	380	PRO	2.5
1	A	379	VAL	2.5
1	A	465	GLU	2.5
1	A	470	LEU	2.4
1	A	490	ASN	2.4
1	A	163	ALA	2.4
1	A	168	ILE	2.4
1	A	488	SER	2.3
1	A	487	ALA	2.3
1	A	164	ILE	2.2
1	A	165	PRO	2.2
1	A	434	THR	2.2
1	A	200	VAL	2.2
1	A	430	SER	2.1
1	A	385	VAL	2.1
1	A	471	ASP	2.1
1	A	382	LEU	2.1
1	A	378	LEU	2.0
1	A	73	THR	2.0
1	A	167	PHE	2.0

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum,

median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
2	SEP	B	385	10/11	0.64	0.33	71,84,94,116	0

6.3 Carbohydrates [i](#)

There are no carbohydrates in this entry.

6.4 Ligands [i](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.